Topic: Quotient rule

Question: Find the derivative.

$$y = \frac{2x^2 - 1}{3x + 5}$$

Answer choices:

A $$y' = \frac{6x^2 - 20x + 3}{(3x + 5)^2}$$

B $$y' = \frac{6x^2 + 20x + 3}{3x + 5}$$

C $$y' = \frac{6x^2 + 20x + 3}{(3x + 5)^2}$$

D $$y' = \frac{6x^2 + 10x + 3}{(3x + 5)^2}$$

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Solution: C

Quotient rule,

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{\left[g(x)\right]^2}$$

tells us that the derivative of our function will be

$$y' = \frac{(3x+5)(4x) - \left(2x^2 - 1\right)(3)}{(3x+5)^2}$$

$$y' = \frac{\left(12x^2 + 20x\right) - \left(6x^2 - 3\right)}{(3x+5)^2}$$

$$y' = \frac{12x^2 + 20x - 6x^2 + 3}{(3x+5)^2}$$

$$y' = \frac{6x^2 + 20x + 3}{(3x+5)^2}$$

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Topic: Quotient rule

Question: Find the derivative.

$$y = \frac{x^2 - x + 1}{x^2 + 1}$$

Answer choices:

A $y' = \dfrac{x^2 - 1}{\left(x^2 + 1\right)^2}$

B $y' = \dfrac{x - 1}{\left(x^2 + 1\right)^2}$

C $y' = \dfrac{x^2 - 1}{x^2 + 1}$

D $y' = \dfrac{x^2}{\left(x^2 + 1\right)^2}$

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Solution: A

Quotient rule,

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{\left[g(x)\right]^2}$$

tells us that the derivative of our function will be

$$y' = \frac{\left(x^2+1\right)\frac{d}{dx}\left(x^2-x+1\right) - \left(x^2-x+1\right)\frac{d}{dx}\left(x^2+1\right)}{\left(x^2+1\right)^2}$$

$$y' = \frac{\left(x^2+1\right)(2x-1) - \left(x^2-x+1\right)(2x)}{\left(x^2+1\right)^2}$$

$$y' = \frac{\left(2x^3-x^2+2x-1\right) - \left(2x^3-2x^2+2x\right)}{\left(x^2+1\right)^2}$$

$$y' = \frac{2x^3-x^2+2x-1-2x^3+2x^2-2x}{\left(x^2+1\right)^2}$$

$$y' = \frac{x^2-1}{\left(x^2+1\right)^2}$$

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Topic: Quotient rule

Question: Find the derivative.

$$y = \frac{1}{3x^2 + 1}$$

Answer choices:

A $$y' = \frac{-6x}{\left(3x^2 + 1\right)^2}$$

B $$y' = \frac{6x}{\left(3x^2 + 1\right)^2}$$

C $$y' = \frac{-6x}{3x^2 + 1}$$

D $$y' = \frac{-6}{\left(3x^2 + 1\right)^2}$$

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Solution: A

The reciprocal rule is a special instance of the quotient rule where the numerator of the function is a constant. It says that the derivative of the rational function will be the negative derivative of the denominator, divided by the square of the denominator.

$$y' = \frac{-\frac{d}{dx}\left(3x^2+1\right)}{\left(3x^2+1\right)^2}$$

$$y' = \frac{-6x}{\left(3x^2+1\right)^2}$$

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